

Although polar bears are capable of living in areas of highly dynamic ice movement, they show inter-annual fidelity to the general location of preferred habitat (Mauritzen et al. 2003b, p. 122; Amstrup et al. 2000b, p. 963).

As sea ice becomes more fragmented, polar bears would likely use more energy to maintain contact with consolidated, higher concentration ice, because moving through highly fragmented sea ice is more energy-intensive than walking over consolidated sea ice (Derocher et al. 2004, p. 167). During summer periods, the remaining ice in much of the central polar basin is now positioned away from more productive continental shelf waters and occurs over much deeper, less productive waters, such as in the Beaufort and Chukchi Seas of Alaska. If the width of leads or extent of open water increases, the transit time for bears and the need to swim or to travel will increase (Derocher et al. 2004, p. 167). Derocher et al. (2004, p. 167) suggest that as habitat patch sizes decrease, available food resources are likely to decline, resulting in reduced residency time and increased movement rates. The consequences of increased energetic costs to polar bears from increased movements are likely to be reduced body weight and condition, and a corresponding reduction in survival and recruitment rates (Derocher et al. 2004, p. 167).

Additionally, as movement of sea ice increases and areas of unconsolidated ice also increase, some bears are likely to lose contact with the main body of ice and drift into unsuitable habitat from which it may be difficult to return (Derocher et al. 2004, p. 167). This has occurred historically in some areas such as Southwest Greenland as a result of the general drift pattern of sea ice in the area (Vibe 1967) and also occurs offshore of Newfoundland, Canada (Derocher et al. 2004, p. 167). Increased frequency of such events could negatively impact survival rates and contribute to population declines (Derocher et al. 2004, p. 167).

Polar Bear Seasonal Distribution Patterns Within Annual Activity Areas

Increasing temperatures and reductions in sea ice thickness and extent, coupled with seasonal retraction of sea ice poleward, will cause redistribution of polar bears seasonally into areas previously used either irregularly or infrequently. While polar bears have demonstrated a wide range of space-use patterns within and between populations, the continued retraction and fragmentation of sea ice habitats

that is projected to occur will alter previous patterns of use seasonally and regionally. These changes have been documented at an early onset stage for a number of polar bear populations with the potential for large-scale shifts in distribution by the end of the 21st century (Durner et al. 2007, pp. 18–19).

This section provides examples of distribution changes and interrelated consequences. Recent studies indicate that polar bear movements and seasonal fidelity to certain habitat areas are changing and that these changes are strongly correlated to similar changes in sea ice and the ocean-ice system. Changes in movements and seasonal distributions can have effects on polar bear nutrition, body condition, and more significant longer term redistribution. Specifically, in western Hudson Bay, break-up of the annual sea ice now occurs approximately 2.5 weeks earlier than it did 30 years ago (Stirling et al. 1999, p. 299). The earlier spring break-up was highly correlated with dates that female polar bears came ashore (Stirling et al. 1999, p. 299). Declining reproductive rates, subadult survival, and body mass (weights) have occurred because of longer periods of fasting on land as a result of the progressively earlier break-up of the sea ice and the increase in spring temperatures (Stirling et al. 1999, p. 304; Derocher et al. 2004, p. 165).

Stirling et al. (1999, p. 304) cautioned that, although downward trends in the size of the Western Hudson Bay population had not been detected, if trends in life history parameters continued downward, “they will eventually have a detrimental effect on the ability of the population to sustain itself.” Subsequently, Parks et al. (2006, p. 1282) evaluated movement patterns of adult female polar bears satellite-collared from 1991 to 2004 with respect to their body condition. Reproductive status and variation in ice patterns were included in the analysis. Parks et al. (2006, p. 1281) found that movement patterns were not dependent on reproductive status of females but did change significantly with season. They found that annual distances moved had decreased in Hudson Bay since 1991. This suggested that declines in body condition were due to reduced prey consumption as opposed to increased energy output from movements (Parks et al. 2006, p. 281). More recently, Regehr et al. (2007a, p. 2,673) substantiated Stirling et al.’s (1999, p. 304) predictions, noting population declines in western Hudson Bay during analysis of data from an ongoing mark-recapture population study. Between 1987 and 2004, the number of polar bears in the

Western Hudson Bay population declined from 1,194 to 935, a reduction of about 22 percent (Regehr et al. 2007a, p. 2,673). Progressive declines in the condition and survival of cubs, subadults, and bears 20 years of age and older appear to have been caused by progressively earlier sea ice break-up, and likely initiated the decline in population. Once the population began to decline, existing harvest rates contributed to the reduction in the size of the population (Regehr et al. 2007a, p. 2,680).

Since 2000, Schliebe et al. (2008) observed increased use of coastal areas by polar bears during the fall open-water period in the southern Beaufort Sea. High numbers of bears (a minimum of 120) were found to be using coastal areas during some years, where prior to the 1990s, according to native hunters, industrial workers, and researchers operating on the coast at this time of year, such observations of polar bears were rare. This study period (2000–2005) also included record minimal sea ice conditions for the month of September in 4 of the 6 survey years. Polar bear density along the mainland coast and on barrier islands during the fall open water period in the southern Beaufort Sea was related to distance from pack ice edge and the density of ringed seals over the continental shelf. The distance between pack ice edge and the mainland coast, as well as the length of time that these distances prevailed, was directly related to polar bear density onshore. As the sea ice retreated and the distance to the edge of the ice increased, the number of bears near shore increased. Conversely, as near-shore areas became frozen or sea ice advanced toward shore, the number of bears near shore decreased (Schliebe et al. 2008). The presence of subsistence-harvested bowhead whale carcasses and their relationship to polar bear distribution were also analyzed. These results suggest that, while seal densities near shore and availability of bowhead whale carcasses may play a role in polar bear distribution changes, that sea ice conditions (possibly similar to conditions observed in western Hudson Bay) are influencing the distribution of polar bears in the southern Beaufort Sea. They also suggest that increased polar bear use of coastal areas may continue if the summer retreat of the sea ice continues into the future as predicted (Serreze et al. 2000, p. 159; Serreze and Barry 2005).

Others have observed increased numbers of polar bears in novel habitats. During bowhead whale surveys conducted in the southern Beaufort Sea during September, Gleason et al. (2006)